Air Force SBIR Impact

Ultra-high Surface Area Aluminum-polymer Nanolaminate Composites

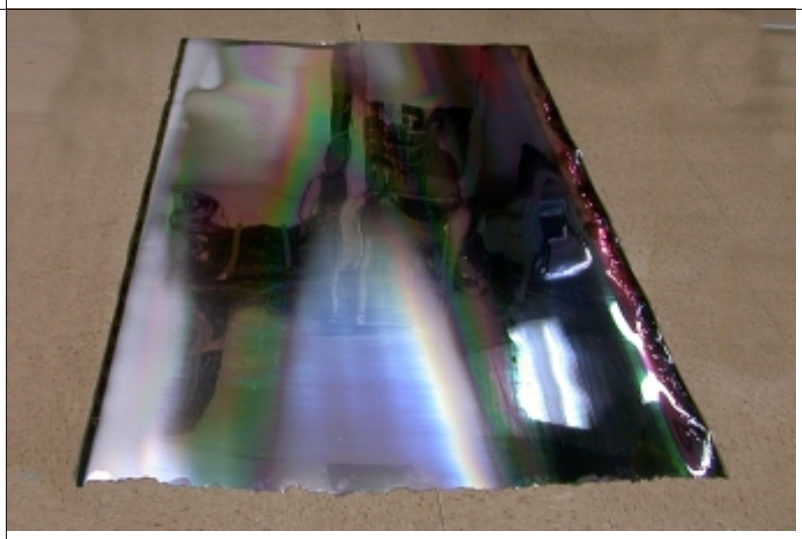
Company:
Sigma Technologies International, Inc.

Location:
Tucson, AZ

Employees:
36

President:
Angelo Yializis, Ph.D.

Project Officer:
Joseph Glenn
AFRL/Munitions Directorate,
Eglin AFB, FL



Pilot-production scale (4 ft x 7 ft) nanolaminate panel which has been removed from the deposition drum and laid flat on the floor. The material may be used "as is" for bulk applications or comminuted to powder for most explosives and propellant applications.

Air Force Requirements:

Air Force Research Laboratory's (AFRL) High Explosive Research and Development (HERD) group was seeking new and innovative energetic materials which would display flat shock front and high brisance but would nevertheless be safe to handle. They wished to incorporate such materials into Tritonal-type formulations and focused, specialty projectiles.

SBIR Technology:

Sigma Technologies International, Inc. was awarded Phase I and Phase II Small Business Innovation Research Program (SBIR) awards to develop ultra-high surface area aluminum-polymer nanolaminate composites for explosive applications.

Sigma has supplemented vacuum metallization with proprietary technology for direct physical vapor deposition and e-beam curing of monomer within a vacuum environment on a chilled, rotating, deposition drum. The resulting structure is comprised of alternating layers of metal (typically aluminum) and an acrylate polymer wherein the individual

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layers are characterized by thickness that is controllable and typically within the range of 20-200 nm. Moreover, the acrylate monomers employed are tailored to specific applications by a suitable combination of blending and in-house molecular synthesis, and may even be an oxidant, thus providing an integrated combustion system. The surface area to weight ratio of the nanostructured material is very large.

Company Impact:

During the Phase II effort, Sigma developed teaming agreements with several defense contractors and a Cooperative Research and Development Agreement (CRADA) with the government. One of the commercial contractors, an airbag system manufacturer, indicated an interest in a variant of the nanolaminate technology characterized by an oxidizing polymer. An example would be one in which aluminum has a very high surface area to weight ratio as in an integrated combustion system. A development program for an enhanced output initiator bridge for airbag deployment was established and is currently underway. Energetic foil samples have been fabricated and are presently being evaluated by the client.

The airbag system manufacturer has issued a purchase order to Sigma for the initial phase of the enhanced output initiator bridge development program and has briefed selected firms in their network regarding the innovative Sigma technology.

Company Quote

"Air Force SBIR support and feedback, both institutional and through our Technical Point of Contact, has played a pivotal role in the early phase, high-risk development of this novel technology and allowed us to make the long-term commitment necessary to achieve commercialization."

Dr. Richard Ellwanger
Sigma Technologies International, Inc.

SBIR

AF SBIR Program Manager
AFRL/XPTT
1864 4th Street, Suite 1, Building 15
Wright-Patterson AFB, OH 45433

AF SBIR Program Manager: Steve Guilfoos
e-mail: steve.guilfoos@afrl.af.mil

Web site: www.tto.wpafb.af.mil/TTO/sbir/index.htm

DSN: 785-0838
DSN Fax: 785-2329
T: (800) 222-0336
F: (937) 255-2329

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